SILICONE OIL AND THE GOLDILOCKS PRINCIPLE

How to achieve the perfect silicone oil fill.

BY DAVID R. P. ALMEIDA, MD, MBA, PHD

Welcome back to another installment of Surgical Meditations. I love to try new surgical techniques and approaches and solve surgical problems with insight, ingenuity, and intrepidness, while being cognizant never to put patients at risk. Below, I answer a question posed by a reader of *Retina Today* with my own considerations and recommendations.

QUESTION

Silicone oil tamponade still gives me anxiety. I fear underfills and overfills. What is the best approach to ensuring a perfect silicone oil fill?

THE SHORT ANSWER

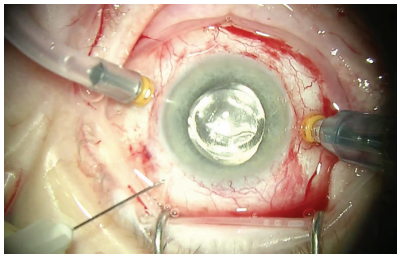
Silicone oil tamponade—commonly used during procedures to address complex retinal detachment repair, uveitis, and hypotony—is a topic I receive a lot of questions on. These cases tend to involve advanced pathology, and frustration can occur when, after addressing the task at hand, the surgeon realizes on postoperative day 1 that overfill or underfill may compromise success. Underfills may inadequately cover inferior retinal pathology and overfills may lead to elevated IOP, necessitating oil exchange and additional surgery.

In the story "Goldilocks and the Three Bears," a little girl named Goldilocks tastes three different bowls of porridge. She dislikes the porridge that is too hot and the porridge that is too cold, but enjoys the third bowl, which is *just* the right temperature. The Goldilocks lesson in silicone oil fills is centered around finding *just* the right amount of oil.

When it comes to silicone oil placement, everyone seems to have his or her own approach to ensuring an adequate fill. The best approach to any surgical technique is that which works best in *your hands*.

For silicone oil tamponade placement, I employ two redundant endpoints and a fail-safe as built-in checks to allow definitive assessment of how much silicone oil has been placed. A common error occurs when only one endpoint parameter is used: If you have only one endpoint or checkpoint, then you are left with no accessory endpoint to verify how much silicone oil you have placed. By using a 30-gauge needle chimney as a visual endpoint and the infusion line as a fail-safe, you can create a system that will allow you to get that Goldilocks amount of oil every time.

WATCH IT NOW



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THE LONG VERSION

Every surgical procedure, no matter how basic or advanced, has one or two critical components that determine success. For application of silicone oil tamponade, those components are excellent visualization and confidence in needle placement.

AT A GLANCE

- Use of silicone oil tamponade during air-fluid exchange presents the risk of overfill or underfill.
- By setting a series of fail-safes, surgeons can achieve an optimum silicone oil fill while reducing the risk of overfill or underfill.

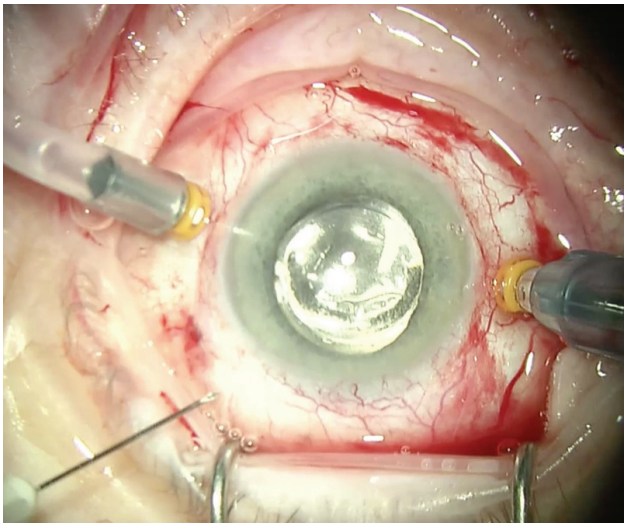

Figure 1. A 30-gauge needle enters at the pars plana near the closed sclerotomy.

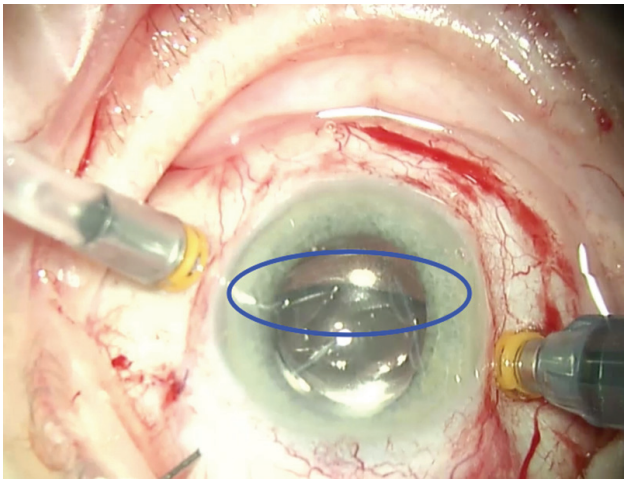

Figure 3. During air-fluid exchange, the anterior face of the silicone oil bubble (blue oval) can be observed behind the crystalline lens or IOL.

After you have addressed the main pathology via surgery, you will want to perform a complete air-fluid exchange. You are now ready for silicone oil tamponade with the eye under air. First, suture one of the superior sclerotomies. If you are right-handed, I recommend you suture the left superior sclerotomy so that you can inject silicone oil with your dominant hand.

At this juncture, you will have air running via the infusion line (I usually keep a compensated IOP of 30-35 mm Hg). Next, you will introduce a 30-gauge needle on a TB syringe via the pars plana in the quadrant with the sclerotomy (Figure 1). Remove the plunger before introducing the needle and syringe to create a passive vent or, as I call it, a *chimney vent*. This will vent air as you inject silicone oil and ensure that IOP does not dramatically rise during oil infusion.

You are now ready to inject silicone oil. (I prefer

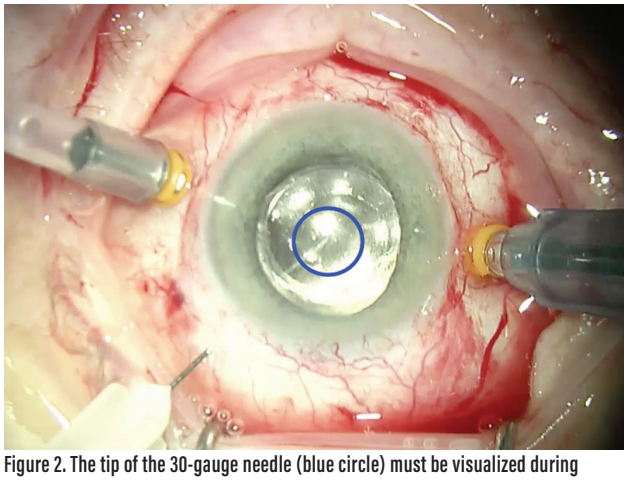

Figure 2. The tip of the 30-gauge needle (blue circle) must be visualized during air-fluid exchange.

1000 cSt oil rather than 5000 cSt oil because of the faster infusion and extraction times of 1000 cSt oil.) You must clearly visualize the tip of the 30-gauge needle (Figure 2). If you are having difficulty visualizing the tip of the 30-gauge needle due to a media opacity such as cataract, adjust your viewing angle so you can confidently maintain a view of the needle tip. Not only will the needle act as a chimney vent, but it will also be a visual assay of your oil fill. This is endpoint fail-safe No. 1.

Now you can start silicone oil infusion. I use maximum viscous fluid infusion pressure (80 mm Hg) and start with air infusion at 30 to 35 mm Hg. You will then create fail-safe endpoint No. 2. During silicone oil infusion, lower the compensated air infusion to 25 mm Hg, then to 20 mm Hg, then to 15 mm Hg, then 10 mm Hg, and finally 8 mm Hg. Lower the compensated IOP every 2 to 4 seconds so that, over the course of about 15 to 20 seconds, you settle at an air infusion pressure of 8 mm Hg. This allows you to safely inject the oil at a maximum infusion rate. The air bubble will escape via the chimney vent, and you can track the anterior face of the silicone oil bubble to the endpoint just behind the crystalline lens or IOL (or behind the iris in aphakic eyes; Figure 3).

Performing these steps during air-fluid exchange activates endpoint fail-safe No. 2: oil backflow via your air infusion line. Oil is infused at a maximum rate, with the compensated IOP at 8 mm Hg. If you miss your 30-gauge needle visual endpoint, the oil will slowly backflow up the infusion line. This occurs because oil is being injected at a higher pressure than the pressure from the air infusion line.

During silicone oil injection, carefully monitor the needle tip and the infusion line. It's imperative to watch

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both of these endpoints because if you miss the needle tip visual cue but see oil flowing up the infusion line, you will know to immediately stop. The combination of cataract, air, and silicone oil commonly conspire to make visualization of the needle tip difficult. This is where the fail-safe redundancy saves the day. If oil creeps up the infusion line, stop the fill and wait approximately 20 to 30 seconds for the pressure to equilibrate. If you still see silicone oil in the infusion line, switch fluid to viscous extraction, and slowly extract the excess silicone oil.

In short, if you can directly visualize the endpoint of silicone oil with the 30-gauge needle as shown in Figure 3, then you don't need to do anything further. However, if visualization is missed, fail-safe No. 2 (the infusion line) will prevent overfill.

Following these steps will allow you to get that Goldilocks amount of silicone oil tamponade in a safe and efficient manner, every time. Visit Eyetube at **bit.ly/Almeida0519** to see a real-life execution of these techniques.

TIDBITS TO TUCK AWAY

Silicone oil placement is a bread-and-butter skill in a retinal surgeon's armamentarium. By creating a system with two fail-safe mechanisms, you can avoid the pitfalls of underfill and overfill. In cases that require silicone oil tamponade, I always suture all sclerotomies to avoid leakage. This procedure is particularly useful in surgeries involving phakic patients with cataract, commonly encountered during repair of diabetic tractional retinal detachments.

WANT ANSWERS?

If you have a question that you would like addressed, please email me (drpa@pm.me) or contact me on Twitter (@davidalmeidaMD). Likewise, if you have comments or criticisms regarding topics addressed in this article, feel free to reach out. I would love to hear from you. ■

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